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EXAMINER
GURLEY, LYNNE ANN

ART UNIT	PAPER NUMBER
2812	

DATE MAILED: 09/09/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/501,124	Applicant(s) BRASE, GABRIELA
	Examiner Lynne A. Gurley	Art Unit 2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *5/27/03* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12 and 24-29* is/are pending in the application.

4a) Of the above claim(s) *24-29* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This Office Action is in response to the amendment filed 5/27/03.
Currently, claims 1-12 and 24-29 are pending.

Election/Restrictions

Claims 24-29 have been withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 5.

Claim Rejections - 35 USC § 103

I. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

II. The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

III. The rejection of claims 1-12 under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (US 6,326,300, dated 12/4/2001, filed 9/21/1998) in view of Jang (US 6,265,319, dated 7/24/2001, filed 9/1/1999) has been maintained for the reasons of record.

Liu shows the method substantially as claimed in figures 1-8 and corresponding text, with conductive regions 11 (column 6, lines 64-67), first layer 10, interlevel dielectric 12, etch stop 14, via patterning (fig. 2), trench dielectric 22, etching of the trench and vias (fig 6) and conductive material 30. Note that it is considered inherent that if a spin-on-polymer were used, a spin-on technique followed by a curing process would be in order. Additionally, Liu teaches that the material of the interlevel dielectric and trench dielectric may be the same or different; that a spin-on polymer may be used; and that the etch stop layer is between 100 nm and 250 nm thick (column 7, lines 42-44).

Liu lacks anticipation only in not teaching that the etch stop may be a polymer with a low dielectric constant (column 1, lines 40-44), even though Liu does teach that the etch stop may be made of any material which resists etching during the interlevel dielectric and trench dielectric etching. Liu also lacks anticipation in not teaching that: 1) the polymer may be polyorylene-ether (FLARE) or polybenzoxazole; 2) a cap layer is formed; 3) and a hard mask is used.

Jang teaches that a polymer such as FLARE may be used as an etch stop layer between two low dielectric constant layers in a dual damascene technique.[1]

It would have been obvious to one of ordinary skill in the art to have used FLARE for the etch stop layer in the method of Liu with the motivation that FLARE would possess suitable etch resistant properties while etching the appropriate dielectric layers.

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[1] For clarification, Jang teaches that FLARE or SILK may be used as the polymer (column 6, lines 8-9). Since Applicant exemplifies SILK as a polyorylene-ether (specification, page 7), the Examiner has interpreted the term "polyorylene-ether" to be, "polyarylene-ether", such as FLARE or SILK, as stated in Jang (column 6, lines 1-12). It appears that the term "polyorylene-ether" is a typographical error.

It would have been obvious to one of ordinary skill in the art to have formed a cap layer and a hard mask in order to improve oxidation resistance and etching profiles during exposure of the device between processing and during lithographical techniques.

Response to Remarks

1. Applicant's arguments filed 5/27/03 have been fully considered but they are not persuasive for the following reasons.

2. In response to Applicant's Remarks, pages 1-3:

Applicant raises the clear issue of whether Liu taken alone or, the combination of Liu in view of Jang, would suggest the use of a polymer in the etch stop layer in Liu, especially since: 1) Liu teaches away from using a polymer in the etch stop layer, since polymers may be used for the interlevel dielectric layers (Remarks, page 2, last paragraph); 2) Liu explicitly teaches silicon nitride or silicon oxynitride as the etch stop material – not a polymer, and without any suggestion to use a polymer, even though Liu teaches that the etch stop material may be formed of any dielectric material (Remarks, page 3, first full paragraph), and; 3) Jang teaches a different damascene process from Liu (Remarks, page 3, second full paragraph).

The Examiner takes the position that the method of forming the damascene structure, as shown in Liu (figs. 1-6), and the implications made by Liu (column 7, lines 25-44), taken in combination with the solid teachings of Jang, would lead one of ordinary skill in the art to have substituted the polymer etch stop, taught in the method of Jang, for the silicon nitride or silicon oxynitride etch stop used in the method of Liu.

In response to Applicant's Remarks, page 2, last paragraph, Liu does not teach away from using polymer etch stop materials by including polymers in the interlevel dielectric layers, especially, when one of ordinary skill in the art considers the variety of materials Liu discloses for the interlevel dielectric layers and, the statement Liu makes that other etch stop materials may be used, as long as the etch stop properties are maintained (column 7, lines 25-44). Liu is simply silent on what other etch stop materials may be used. Liu explicitly teaches the use of silicon-containing glass layers, in addition to the use of polymer interlevel dielectric layers. It takes the disclosure of Jang to realize that the combination of silicon-containing interlevel dielectrics and a polymer etch stop layer is both possible and reasonable. The same silicon-containing glass layers are explicitly taught in Jang for the interlevel dielectric layers, and, Jang additionally teaches that a polymer etch stop material may be used between these silicon-containing glass interlevel dielectric layers. So that, if the silicon-containing glass dielectric layers, as disclosed in Liu, were used in the method of Liu, one of ordinary skill would find it both possible and reasonable to substitute the polymer etch stop layer, taught in Jang, for the silicon nitride or silicon oxynitride etch stop taught in Liu, with all etch stop properties maintained, as taught in Jang.

In response to Applicant's Remarks, page 3, first full paragraph, although Liu explicitly teaches silicon nitride or silicon oxynitride as the etch stop materials, the statement that Liu makes in reference to the etch stop layer being formed of any material which effectively serves as an etch stop (column 7, lines 25-44), implies that additional materials to the silicon nitride and oxynitride may be used, as long as the etch stop properties are retained with respect to the interlevel dielectric layers. Again, Jang supplies the suggestion of the explicit combination, with

the motivation that the polymer etch stop material provides a lower inter-level capacitance and a lower contact resistance for an improved dual-damascene process with the silicon-containing glass layers.

In response to Applicant's Remarks, page 3, second full paragraph, that there is no suggestion to combine the references, based on the fact that the processes are different in Liu and Jang, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, although the damascene processes are not identical for Liu and Jang, it is not necessary that they be identical in order for them to be relied upon for what they teach in combination – Jang supplements and suggests modification to Liu's process as well as provides motivation to modify Liu's process to use a polymer etch stop instead of a silicon nitride or silicon oxynitride etch stop, as addressed in the previous paragraphs.

In general, and in response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Finally, to further clarify and summarize the Examiner's position, Liu alone is relied upon for showing the damascene structure formation steps of the claimed invention: *providing conductive regions 11 on a first layer 10; forming an interlevel dielectric layer 12 over the first layer; forming an etch stop layer 14 over the interlevel dielectric layer; patterning the etch stop layer to form a via pattern (Fig. 2);*

depositing a trench dielectric layer 22 (fig. 4) on the etch stop layer and in the holes of the via pattern; forming trenches in the trench dielectric layer by etching the trench layer in accordance with a trench patter (fig. 5); and forming vias in the interlevel dielectric layer by etching through the trenches using the etch stop layer to self-align the trenches to the vias and expose the conductive regions on the first layer (fig. 6) (claim 1). The conductive regions are diffusion regions (claim 3). The interlevel dielectric layer and the trench dielectric layer may be comprised of a same material (claim 5; column 7, lines 8-25) or of different materials (claim 8; column 7, lines 8-25). The same material may be a nitride or oxide (claim 6; column 7, lines 8-25). The interlevel dielectric layer and the trench dielectric layer are selectively etchable relative to the etch stop layer (claim 7; column 7, lines 26-40). Contacts are formed by depositing conductive material 30 to form contacts in the vias and conductive lines in the trenches (claim 10; fig. 8). The etch stop layer includes a thickness of between about 100 nm to about 250 nm (claim 12; column 7, lines 42-44). Additionally, Liu teaches that spin-on-polymers may be used in the method (explicitly as the interlevel dielectric layers) and that these materials ,in general, are low dielectric constant and more advanced, having a dielectric constant less than about 3.0 (column 1, lines 40-67; column 2, lines 1-41; column 7, lines 17-22. Since Liu does not explicitly teach that the etch stop layer includes a polymer material having a dielectric constant of less than about 3.0, Jang is relied upon for the teaching of the compatibility of a polymer etch stop with the dielectric layers shown in Liu. Both Liu and Jang show that the interlevel dielectric layers may be selected from silicon-containing glass layers, at about the same thickness (Jang, column 5, lines 48-61; column 6, lines 25-30 and; Liu, column 7, lines 8-17). As an improvement to the damascene process, Jang uses a polymer etch stop layer between the silicon-containing glass interlevel dielectric layers in the process in order to reduce the inter-level capacitance and to lower the resistance of the contact (column 5, lines 62-67; column 6, lines 1-24; column 3, lines 1-10 and 42-47; column 7, lines 15-17; column 8, lines1-21). Therefore, one of ordinary skill in the art would have recognized that the silicon nitride or silicon oxynitride etch stop layer between the dielectric layers, as shown in the method

of Liu, could have been replaced by a polymer etch stop layer, as taught in Jang, with motivation and surety that the polymer layer would still function as an etch stop and, would result in an improved damascene contact with lower inter-level capacitance and resistance, especially in the case where the silicon-containing glass interlevel dielectric layers are used.

Conclusion

1. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne A. Gurley whose telephone number is (703) 305-3474. The examiner can normally be reached on Monday-Friday from 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John F. Niebling, can be reached on (703) 308-3325. The fax phone number for the organization where this application or proceeding is assigned is 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 308-0956.

LYNNE GURLEY
PATENT EXAMINER
Art Unit 2812

LAG

August 28, 2003